WEST NILE VIRUS

Also Known as: WNV

Responsibilities:
Hospital: Report by IDSS, facsimile, mail or phone, Infection Preventionist involvement in follow-up may vary.
Lab: Report by IDSS, facsimile, mail, or phone
Physician: Report by facsimile, mail, or phone
Local Public Health Agency (LPHA): Report by IDSS, facsimile, mail, or phone. Initiates Follow-up, works with Infection Preventionist

Iowa Department of Public Health
Disease Reporting Hotline: (800) 362-2736
Secure Fax: (515) 281-5698

1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Agent

West Nile Virus is a flavivirus first found in Africa, West Asia, and the Middle East. It is closely related to St. Louis encephalitis virus, which is found in the United States. Presence of the virus was first identified in the United States in 1999. The virus can infect humans, birds, mosquitoes, horses and other mammals.

B. Clinical Description

Non-neuroinvasive disease: West Nile Fever is another type of illness that can occur in people who become infected with the virus. It is characterized by fever, headache, tiredness, aches, and sometimes rash. Although the illness can be as short as a few days, even healthy people have been sick for several weeks.

Neuroinvasive disease: Neuroinvasive disease is a severe manifestation of WNV because it affects a person's nervous system. Neuroinvasive disease includes: West Nile encephalitis (inflammation of the brain), West Nile meningitis (inflammation of the membrane around the brain and the spinal cord), and West Nile meningoencephalitis (inflammation of the brain and the membrane surrounding it). Clinical syndromes may include aseptic meningitis, myelitis, and encephalitis. Less common neurological syndromes may include cranial and peripheral neuritis/neuropathies, including Guillain-Barré syndrome. It is important to understand that neuroinvasive disease is not just limited to encephalitis and meningitis.

Symptoms
(Non-neuroinvasive disease): Most people who are infected with the West Nile virus will not have any type of illness. It is estimated that about 20% of the people who become infected will develop West Nile fever. Symptoms include fever, headache, tiredness, and body aches, and occasionally a skin rash on the trunk of the body and swollen lymph glands.

Symptoms (Neuroinvasive disease): Symptoms include headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, and paralysis. It is estimated that approximately 1 in 150 persons infected with the West Nile virus will develop a more severe form of disease.

C. Reservoirs

West Nile Virus is carried by birds. WNV has been identified in more than 200 species of birds found dead in the United States. The virus usually stays in birds and the mosquitoes that feed on them. Rarely, other kinds of mosquitoes that also bite people and horses pick up the viruses. Humans and horses are considered dead-end hosts, meaning they do not transmit the virus on further.

D. Modes of Transmission

WNV is spread to humans by the bite of an infected mosquito. There have been documented cases of intrauterine, transfusion-associated, and organ transplant transmission of WNV. Improvements to the sensitivities of the tests used to screen blood will reduce the risk of transmission.

E. Incubation Period

The incubation period for WNV disease is typically 2 to 6 days but ranges from 2 to 14 days and can be several weeks in immunocompromised people.

F. Period of Communicability or Infectious Period

West Nile encephalitis is NOT transmitted from person-to-person. For example, a person cannot get West Nile virus from touching or kissing a person who has the disease, or by caring for someone with the disease.

G. Epidemiology

Before the fall of 1999, WNV had not been documented in the Western Hemisphere. WNV was first isolated in the West Nile Province of Uganda in 1937. The first epidemic was in Israel during the 1950s. In 1999, human cases of WNV were identified in New York City. Iowa first identified WNV in a bird in 2001. The first human cases occurred in Iowa in 2002 and 147 human WNV cases were identified in 2003. In 2009, 9 cases were reported in Iowa, and in 2012 31 cases were reported.

Individuals who spend time outdoors, when mosquitoes are present (typically spring through fall in Iowa), are at risk of being bitten by an infected mosquito. The more time individuals spend outdoors, the greater the risk of being bitten by an infected mosquito. Individuals over 50 years of age are at an increased risk of becoming ill with severe symptoms if bitten by an infected mosquito. The seasonality of WNV transmission is variable and depends on the geographic location of exposure, the specific cycles of viral transmission, and local climatic conditions.

H. Bioterrorism Potential

None.

2) DISEASE REPORTING AND CASE INVESTIGATION

A. Purpose of Surveillance and Reporting

- To identify locally acquired cases of WNV infection in humans to help target mosquito control measures.
- To identify cases of other arboviral infections in Iowa residents or visitors to determine whether they are imported or locally acquired.
- To identify cases of WNV infection to understand the epidemiology of this emerging disease in our area.
- To provide residents of Iowa and travelers to the state with appropriate preventive health information.

Laboratory and Healthcare Provider Reporting Requirements

Iowa Administrative Code 641-1.3(139) stipulates that the laboratory and the healthcare provider must report. The preferred method of reporting is by utilizing the Iowa Disease Surveillance System (IDSS). However, if IDSS is not available, the reporting number for IDPH Center for Acute Disease Epidemiology (CADE) is (800) 362-2736; fax number (515) 281-5698, mailing address:

IDPH, CADE
Lucas State Office Building, 5th Floor
321 E. 12th St.
Des Moines, IA 50319-0075

Postage-paid disease reporting forms are available free of charge from the IDPH clearinghouse. Call (319) 398-5133 or visit the website: healthclrhouse.drugfreeinfo.org/cart.php?target=category&category_id=295 to request a supply.

Laboratory Testing Services Available

The University of Iowa State Hygienic Laboratory (SHL) performs antibody detection for West Nile virus using enzyme immunoassay (EIA) methods. Single acute sera and cerebrospinal fluid (CSF) are tested for the presence of IgM antibodies. WNV antibodies develop soon after onset and peak around 8 days, therefore, sera and CSF collected 5-10 days post onset are ideal specimens for testing. The presence of IgM antibody usually indicates recent infection by this virus; however, it has been shown that IgM antibodies to WNV may persist for many months after onset. IgG testing is not routinely done. Confirmatory testing, if indicated, is performed at the CDC. Accurate information about date of specimen collection, date of onset of symptoms, travel history, vaccination and disease history are helpful for test result interpretation. For information on specimen submission and testing, contact SHL at (319) 335-4500. Additional information, test request forms, and sample collection instructions can be found at the SHL web site at: www.shl.uiowa.edu/

C. Local Public Health Agency Follow-Up Responsibilities

Case Investigation

a. The local public health agency (LPHA) should follow-up on reported cases of WNV.
b. Neuroinvasive disease includes diagnoses of West Nile encephalitis, West Nile meningitis or West Nile meningoencephalitis, neuritis/neuropathies, or myelitis. The severe WNV illnesses typically require hospitalization. The LPHA should work with the infection preventionist (IP) at the hospital to complete the WNV case investigation in IDSS.
c. Non-neuroinvasive disease includes WNV Fever and any other diagnoses of WNV including symptoms consistent with the illness and/or clinically apparent disease not involving encephalitis, meningitis or meningoencephalitis (neurological involvement). LPHA will complete the investigation for WNV.
d. Asymptomatic test positives include individuals who have been infected with and tested positive for WNV without becoming ill (remaining asymptomatic or without clinically apparent disease). Please note in IDSS if this is the situation.
e. If several attempts have been made to obtain case information, but have been unsuccessful (e.g., the case or healthcare provider does not return calls or respond to a letter, or the case refuses to divulge information or is too ill to be interviewed), complete the investigation with as much information as has been gathered. Please note the reason why it could not be completed. If using IDSS, select the appropriate reason under the Event tab in the Event Exception field.

3) CONTROLLING FURTHER SPREAD

A. Isolation and Quarantine Requirements

None

B. Protection of Contacts of a Case

None

C. Managing Special Situations

Reported Incidence Is Higher than Usual/Outbreak Suspected

If an outbreak is suspected, contact IDPH/CADE at (800) 362-2736. The situation may warrant an investigation of clustered cases or implementation of effective prevention and control measures (*e.g.,* spraying for mosquitoes). CADE can assist in determining a course of action to prevent further cases and can perform surveillance for cases across county lines that can be difficult to identify at a local level.

D. Preventive Measures

Surveillance

In Iowa, CADE, Iowa State University, the State Hygienic Laboratory, and the Iowa Department of Agriculture and Land Stewardship conduct surveillance for arboviral diseases including West Nile virus, through mosquito trapping and testing, sentinel chicken testing, dead bird collection and testing, and through the monitoring of human and equine cases. Results of these surveillance efforts are used to detect the presence of the virus to help target prevention and control measures throughout the state.

CADE, in cooperation with other state agencies, may provide guidance in the use of pesticides for the control of mosquitoes (e.g., "mosquito fogging"). However, decisions regarding the use of larvicides and/or adulticides for mosquito control are typically made by local cities and towns based on mosquito habitat and density, primarily for control of nuisance mosquitoes.

Personal Preventive Measures/Education

The easiest and best way to avoid WNV is to prevent mosquito bites. When outdoors, use insect repellents containing DEET (N, N-diethyl-meta-toluamide) and follow the directions on the package. DEET is the most effective insect repellent available. Repellants containing picaridin and oil of lemon eucalyptus have also been found to be effective.

A higher percentage of DEET in a repellent does not provide better protection, just longer protection. DEET concentrations higher than 50% do not increase the length of protection. The recommended concentration of DEET for adults is 30% and 10% for children and infants over 2 months of age. According to the label, oil of lemon eucalyptus products should NOT be used on children under 3 years. Use repellents at the lowest effective concentration. Wash treated skin with soap and water after returning indoors. Wear long-sleeved shirts, long pants, and socks when possible. Spray clothing with products containing DEET or permethrin, as mosquitoes may bite through thin clothing. Permethrin should only be used on clothing; do not apply it directly to skin. Wash treated clothing before wearing it again. Many mosquitoes are most active at dusk and dawn; consider staying indoors during these hours.

Environmental Preventive Measures

Make sure to have good screens on windows and doors to keep mosquitoes out. Get rid of mosquito breeding sites by eliminating old tires and tin cans, as well as emptying standing water from flowerpots, buckets, barrels and children's wading pools when not in use. Change the water in pet dishes and replace the water in birdbaths weekly. Drill holes in tire swings so water drains out.

4) ADDITIONAL INFORMATION

The Council of State and Territorial Epidemiologists (CSTE) surveillance case definitions for West Nile Virus can be found at: www.cdc.gov/osels/ph_surveillance/nndss/phs/infdis.htm#top

CSTE case definitions should not affect the investigation or reporting of a case that fulfills the criteria in this chapter. (CSTE case definitions are used by the state health department and the CDC to maintain uniform standards for national reporting.)

Comment

Interpreting arboviral laboratory results

- **Serologic cross-reactivity.** In some instances, arboviruses from the same genus produce cross-reactive antibodies. In geographic areas where two or more closely-related arboviruses occur, serologic testing for more than one virus may be needed and results compared to determine the specific causative virus. For example, such testing might be needed to distinguish antibodies resulting from infections within genera, e.g., flaviviruses such as West Nile, St. Louis encephalitis, Powassan, Dengue, or Japanese encephalitis viruses.
- **Rise and fall of IgM antibodies.** For most arboviral infections, IgM antibodies are generally first detectable at 3 to 8 days after onset of illness and persist for 30 to 90 days, but longer persistence has been documented (e.g, up to 500 days for West Nile virus). Serum collected within 8 days of illness onset may not have detectable IgM and testing should be repeated on a convalescent-phase sample to rule out arboviral infection in those with a compatible clinical syndrome.
- **Persistence of IgM antibodies.** Arboviral IgM antibodies may be detected in some patients months or years after their acute infection. Therefore, the presence of these virus-specific IgM antibodies may signify a past infection and be unrelated to the current acute illness. Finding virus-specific IgM antibodies in CSF or a fourfold or greater change in virus-specific antibody titers between acute- and convalescent-phase serum specimens provides additional laboratory evidence that the arbovirus was the likely cause of the patient's recent illness. Clinical and epidemiologic history also should be carefully considered.
- **Persistence of IgG and neutralizing antibodies.** Arboviral IgG and neutralizing antibodies can persist for many years following a symptomatic or asymptomatic infection. Therefore, the presence of these antibodies alone is only evidence of previous infection and clinically compatible cases with the presence of IgG, but not IgM, should be evaluated for other etiologic agents.
- **Arboviral serologic assays.** Assays for the detection of IgM and IgG antibodies commonly include enzyme-linked immunosorbent assay (ELISA), microsphere immunoassay (MIA), or immunofluorescence assay (IFA). These assays provide a presumptive diagnosis and should have confirmatory testing performed. Confirmatory testing involves the detection of arboviral-specific neutralizing antibodies utilizing assays such as plaque reduction neutralization test (PRNT).
- **Other information to consider.** Vaccination history, detailed travel history, date of onset of symptoms, and knowledge of potentially cross-reactive arboviruses known to circulate in the geographic area should be considered when interpreting results.

References

American Academy of Pediatrics. *1997 Red Book: Report of the Committee on Infectious Diseases, 24th Edition*. Illinois, American Academy of Pediatrics, 1997.
CDC Website. West Nile Virus. Available at www.cdc.gov/ncidod/dvbid/westnile/index.htm
Evans, A. *Viral Infections of Humans: Epidemiology and Control, Second Edition*. New York City, Plenum Medical Book Company, 1984.

Heymann, D.L., ed. *Control of Communicable Diseases Manual, 20th Edition.* Washington, DC, American Public Health Association, 2015.
Moellering, R. *Infectious Disease Clinics of North America: Animal- Associated Human Infections*. Philadelphia, W.B. Saunders Co., 1991.

Additional Resources

Additional information regarding WNV, pesticide use, occupational exposures and other topics may be obtained using the following websites:
Environmental Protection Agency www.epa.gov/pesticides/health/mosquitoes/.
U.S. Department of Labor/OSHA www.osha.gov/dts/shib/shib082903b.html